The competitive impact is certainly at least double that, when one adds in the effect of data traffic from business customers, and takes into account the fact that high-speed data links carry far more traffic per user than low-speed voice links.[64] Indeed, a recent study found that, for the first time, total hours spent on the Internet using high-speed connections have eclipsed the number of hours spent using dial-up connections.[65] And broadband access usage is growing at more than 60 percent a year, while dial-up access usage is steadily declining.[66]

Cable and DSL providers (ILECs among them) are now adding new broadband data connections at a rate of some five million new connections a year.[67] Cable supplies about two out of three of these connections.[68] But even if they are using DSL services over ILEC loops, these customers no longer rely on the ILEC switch to route their data traffic: a splitter in the central office diverts data traffic directly to a packet-switched network before it ever reaches an ILEC circuit switch.[69]

Many business customers likewise rely on high-capacity connections of some kind – such as T-1 lines, or higher capacity loops – to provide direct connections between their LANs and their data carriers. As discussed in Sections III.B and IV.A, CLECs have deployed extensive fiber networks to connect business customers directly to packet-switched networks.[70] In addition, there are a large number of carrier-agnostic wholesale fiber suppliers that operate fiber networks in most major metropolitan areas.[71] And the economic viability of deploying fiber is increasing as the demand for greater bandwidth continues to grow at rapid rates.[72]

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sessions last about 10 times longer than voice phone calls: 30 to 40 minutes on average, compared to the 3- to 4-minute duration of a voice call."); Lucent Press Release, *Lucent Technologies Media Gateway Enhancements Complement Lucent Softswitch, Providing Path to IP-Based Networks* (Jan. 16, 2001) ("Most people access the Internet by using dial-up modems connected through the public switched telephone network (PSTN). Those calls tend to last much longer than voice calls, which use up more channels and create congestion on the Internet."); S. Deng, *Engineering and Economic Benefits of Off-loading Dial-Up Traffic from the PSTN*, Nortel Networks White Paper (July 1999), http://www.nortelnetworks.com/products/library/collateral/80009.25-07-99.pdf ("The emergence of dial-up traffic is changing the PSTN traffic pattern considerably, causing network congestion. An average dial-up call lasts 20 minutes (or 12 CCS versus three CCS for a voice call), and 40 percent of the calls last an hour or longer.").

[64] *See, e.g., Broadband 2001* at Charts 16 and 17 (as broadband users, survey participants spent on average 21.4 hours per month online, as compared to 15.9 hours with a narrowband connection. These same users also spent more time per session (32 minutes vs. 21 minutes), spent more days online (18 vs. 17) and viewed more pages per month (1,828 vs. 1,561)); Jupiter Media Metrix Press Release, *Over 40 Percent of US Online Households to Connect Via Broadband by 2006, Reports Jupiter Media Metrix* (Oct. 17, 2001) ("Broadband consumers continue to use their connections more intensively than narrowband consumers do").

[65] *See Broadband Access Usage Outpaces Dial-Up Access*, Reuters (Mar. 5, 2002).

[66] *See id.*

[67] *See TeleChoice DSL Deployment Summary* (residential DSL); *Morgan Stanley Cable Modem/xDSL Report* at Exh. 3 (cable modem).

[68] *See TeleChoice DSL Deployment Summary*; *Morgan Stanley Cable Modem/xDSL Report* at Exh. 3.

[69] *See* G. Garceau, *Network Access Economies*, Telcordia Technologies White Paper (Apr. 12, 1999).

[70] *See also* Appendix K.

[71] *See* Section III.C.

[72] *See id.*

Wireless services provide additional links to packet-switched networks. Paging spectrum is now being used extensively for e-mail and instant messaging, and new devices to support such services are emerging rapidly.[73] Cell phones, paging services (like the BlackBerry service), and personal digital assistants (PDAs) now provide wireless e-mail that is superior to dial-up wireline in that it is both mobile and "always on."[74] The Commission's *Sixth CMRS Report* concluded that about 2.5 million customers, or about 2.3 percent of all mobile telephone subscribers, were using wireless web services at the end of 2000.[75] A more recent analyst report found 6.7 million users of wireless data services.[76] Wireless data has grown from a virtually non-existent market in 1998 to $250 million in 2001, and is expected to grow to $2 billion by 2003.[77]

An increasing number of business customers also are making direct connections to packet switches using a new generation of IP-Based PBXs.[78] Although IP-PBX devices invariably provide connections (through a trunk) to the circuit-switched network, one of their key advantages is to send a great deal of voice traffic over private data networks such as a corporation's local area network or wide area network. Because traffic remains on a private network, rather than going on to the public Internet, the corporation can configure the network to optimize quality to ensure high-level voice communications.[79] IP-PBXs cost less to purchase and operate than traditional PBXs,[80] and are more flexible in terms of adding new services.[81]

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[73] *See, e.g.*, R. Cihra, ING Baring Furman Selz, Investext Rpt. No. 2422947, Palm Inc. – Company Report at *5 (Jan. 4, 2001) ("We see huge consumer and wireless Internet potential for handhelds, with their largest, yet still relatively untapped, opportunity in the corporate enterprise."); R. Cihra, ABN AMRO, Investext Rpt. No. 8264582, PC System & Appliances: Things to Watch in '02 – Industry Report at *2 (Nov. 7, 2001) ("[w]e see handhelds increasingly being deployed as mobile thin-clients for business-critical data access/entry."); *Legg Mason Wireless Industry Scorecard* at 28 ("We believe continued uptake of two-way messaging and lower-speed wireless data products will increase familiarity and acceptance").

[74] *See Sixth CMRS Report* at 56-74.

[75] *Id.* at 60.

[76] *See Legg Mason Wireless Industry Scorecard* at Exh. 11.

[77] *See JP Morgan Telecom Services 2001 Report* at Table 1.

[78] *See, e.g.*, A. Sulkin, *On-Going Evolution of IP-PBX Systems*, Bus. Comm. Review at 14 (May 1, 2000) ("The core architecture platform of PBX systems is undergoing an important transition from circuit-switched to packet-switched transmission and coding techniques."); C.Wilde, *IP PBX Basics*, Informationweek.com News (May 14, 2001), http://www.informationweek.com/shared/printArticle?article=infoweek/837/ ippbx_side.htm&pub=iwk. (An IP-PBX "delivers PBX-like services, but over IP-based LANs or WANs rather than circuit-switched networks.").

[79] *See, e.g., VoIP: Shouldn't You Be Using It?*, Distribution Management Briefing at 14 (Nov. 27, 2001) ("With a private data network . . . an organization can . . . optimize . . . [b]y labelling voice packets, prioritising them over other traffic and using queuing techniques and buffers to control the flow of packets, organizations can ensure that packets are delivered to their destination at a constant rate."); Communications Daily at 7 (Jan. 23, 2002) (Companies that have converted their traditional PBX systems to IP local area networks report that they are "satisfied with the reliability and voice quality of these initial systems") (quoting results of study by InfoTech, *IP LAN Telephony: Probing the Shift in Market Demand*); A. Joch, *Enterprises Tuning in to a Brand-new Voice - Satisfied with Service Quality, Many Enterprises Are Expanding VOIP Use*, eWeek at 41 (June 25, 2001) (IP-PBX vendors – including 3Com and Cisco – now incorporate data-coding protocols into their VOIP hardware to give voice packets network priority when there's heavy network traffic).

[80] *See, e.g.*, M. Desmond, *Enterprise Technology: IP Telephony Goes to Work*, PC World.com (Aug. 2001) ("For growing small businesses – 200 users or more – 'Cisco makes [an IP] gateway that's about $25,000. But when you look at an investment into a PBX, it's typically $150,000 to $200,000 for comparable hardware.'") (quoting Ken Camp, Mill Associates); D. Drucker, *Modest Victories for VoIP – While big enterprises ponder over deployment,*

According to analyst studies, "17 percent of U.S. businesses began the implementation of IP LAN telephony in the year 2000,"[82] and, as of year-end 2001, "[m]ore than 40% U.S. companies with 500 employees or more have begun conversion of phone systems to IP telephony."[83] Analysts predict that, within the next four years, more than 80 percent of all U.S. enterprises will adopt some form of VoIP.[84] According to Frost & Sullivan, the North American IP-PBX market generated $375 million in 2000, and is expected to reach $4.8 billion by 2007.[85]

Packet Switching is Fully Competitive. The Commission has already concluded that CLECs stand on equal footing with ILECs in their ability to deploy and operate packet switches.[86] Since the last UNE review, the installed base of CLECs' packet switches has jumped from 860 to at least 1,700.[87] More than 55 CLECs have deployed packet switches.[88] *See* Appendix E. CLECs have deployed packet switches in more than 200 different cities. *See id.* In the top 100 MSAs, the average number of packet switches per MSA has grown by an average of nearly 150 percent since the last UNE review. *See* Table 11.

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smaller users find savings, InternetWeek at 24 (Sept. 17, 2001) ("The IP PBX cost about one-quarter of what a traditional PBX deployment would have cost."); S. Sleeper, *Networking Giant Finds Its Voice*, Investor's Bus. Daily (May 29, 2001) ("Because they are Web-based, [IP-PBXs] are easier to customize, cheaper to maintain than older networks and simpler to operate"); *ZDNet Tech Update: Advantages of Network PBX* (maintenance costs of IP-PBX can be cut by as much as 5 to 70 percent compared to conventional PBX equipment).

[81] A traditional PBX system is proprietary, and "customers usually have to ask their vendor to add new applications and pay for the service." C. Wilde, *IP PBX Basics*, Informationweek.com (May 14, 2001). In contrast, with an IP-PBX, "a few clicks from a management console or a Web Browser gets the job done." *ZDNet Tech Update: Advantages of Network PBX. See also* Sphere, *IP PBX*, http://www.spherecom.com/solutions/ippbx.htm ("Setting up new users and tasks like moves/adds/changes get done with a point-and-click instead of physically moving wires and phones.").

[82] J. Thompson, *VoIP: The Quiet Revolution*, Boardwatch Magazine (June 2001).

[83] Communications Daily at 7 (Jan. 23, 2002) (quoting results of study by InfoTech, *IP LAN Telephony: Probing the Shift in Market Demand*); *see also* S. Sleeper, *Networking Giant Finds Its Voice*, Investor's Bus. Daily (May 29, 2001) ("Sage Research Inc. of Natick, Mass., found that 52% of firms surveyed plan to install at least a partial IP system by September vs. 16% in September 2000.").

[84] *See, e.g.*, J. Thompson, *VoIP: The Quiet Revolution*, Boardwatch Magazine at 50 (June 2001); *see also* B. Sullivan, *IP PBX: The Quiet Storm*, Communications Today (Feb. 14, 2001), http://www.findarticles.com/cf_0/m0BMD/29_7/70458948/print.jhtml (Avaya President and CEO Don Peterson: "IP is not a question anymore. IP will be the core").

[85] K. Mayer and D. Callahan, *This Old Enterprise*, Communications Solutions (Sept. 2001); *see also id.* (Frost & Sullivan "anticipates that IP-PBX desktops will account for more than half the total number of CPE stations shipped by 2006.").

[86] *See, e.g., UNE Remand Order* ¶ 307 ("Competitive LECs and cable companies appear to be leading the incumbent LECs in their deployment of advanced services."); *id.* ¶ 308 (packet switches "are available on the open market at comparable prices to incumbents and requesting carriers alike. Incumbent LECs and their competitors are both in the early stages of packet switch deployment, and thus face relatively similar utilization rates of their packet switching capacity. . . . It therefore does not appear that incumbent LECs possess significant economies of scale in their packet switches compared to the requesting carriers.").

[87] *See NPRG CLEC Report 2000, 12th ed.*, Ch. 6 (competing carriers had 860 packet switches as of year-end 1998); *NPRG CLEC Report 2002, 15th ed.*, Ch. 4 at Table 18. As noted above (see note 6, *supra*), this figure is highly conservative.

[88] *NPRG CLEC Report 2002, 15th ed.*, Ch. 4 at Table 18.

Table 11. Average Number of CLEC Packet Switches in Top 100 MSAs			
MSA Rank	**1998**	**2001**	**Percent Increase**
1-25	7	16	125
26-50	4	10	158
51-75	2	7	246
76-100	1	2	60
Source: New Paradigm Resources Group. *See* Appendix M.			

The two main kinds of packet switches used today are Frame Relay and ATM switches.[89] One new packet-switching technology – Gigabit Ethernet – has recently been deployed, and is growing as an alternative to Frame Relay and ATM for very high-bandwidth applications.

The largest providers of both Frame Relay and ATM services are AT&T, WorldCom, and Sprint, which control more than two-thirds of the nationwide market for these services. *See* Figure 5.[90] While the precise numbers of Frame Relay and ATM switches these carriers operate are unavailable, it is clear that they all operate vast nationwide Frame Relay and ATM networks. *See* Appendix I.[91] As one analyst has noted, "[t]he Big 3 IXCs own the U.S. frame relay market, have scale economies and are best positioned to influence users and move the market."[92] Numerous other CLECs also provide ATM or Frame Relay service. *See* Appendix I.[93] And while the Bell companies compete in the provision of these packet switching services as well, they have been significantly hampered by the fact that they cannot provide interLATA packet-switching services, despite the fact that customers typically desire a single carrier to provide both intraLATA and interLATA packet switching.[94]

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[89] *See IDC Packet Switching Report* at 1 & Figure 2 (frame relay and ATM services account for 96.4 percent of the packet-switching market).

[90] *See IDC Packet Switching Report* at Figures 9, 31 (AT&T, WorldCom, and Sprint together accounted for 65.8 percent of revenues for ATM, and 68.4 percent of revenues for frame relay in 2000); *Stratecast ATM/Frame Relay Report* at 10 ("Tier 1 service providers continue to dominate the U.S. market, controlling over 70% of the market."); *id.* at 17 ("In 2000, AT&T held the largest share of ATM service revenues, with a 36% share of [the] market; WorldCom and Sprint held the second and third leading position in the market with shares of 26% and 22%, respectively. As in the frame relay market, the RBOCs collectively represent a small share of the ATM services market.").

[91] AT&T Corp., *AT&T ATM Service, Brochure*, http://www.ipservices.att.com/brochures/atm.pdf (AT&T's domestic Frame Relay and ATM network has over 620 Points of Presence (POP)); *IDC Packet Switching Report* at 137 (700+ POPs for WCOM); WorldCom, *US Products, Data Networking, Frame Relay*, http://www.worldcom.com/us/products/datanetworking/framerelay/index.phtml (402 Frame Relay POPs); Sprint Corp., *Sprint Business, Dedicated Access, Service and Support*, http://www.sprintbiz.com/small_business/dedicated_ip/ (320 POPs).

[92] *Stratecast ATM/Frame Relay Report* at 12.

[93] The FCC already has recognized in the past that "it is precisely in the provision of services like frame relay that competition is most intense, and we acknowledge the sensitivity of the LECs' position as they face increasing competition, especially regarding these services that are likely to be related to nonregulated and highly competitive services." *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 8 FCC Rcd 7474, ¶ 63 (1993).

[94] As noted by industry analysts and CLECs alike, Bell companies are limited in their broadband offerings due to restrictions on the provision of interLATA services. *See, e.g., Stratecast ATM/Frame Relay Report* at 12 ("Thus far, the RBOCs have held a very small share of the frame relay market, primarily because they have only been allowed to

The newest packet-switching technology being provided in metropolitan areas is Gigabit Ethernet.[95] Competitive carriers also lead in the deployment of Gigabit Ethernet switches.[96] As one analyst notes, "metro Ethernet services [are] being aggressively marketed by companies such as Yipes[,] Time Warner Telecom, XO, and Telseon."[97] These services are now available in central business districts of top tier markets, but also are being deployed more widely. Revenues for Gigabit Ethernet are still small – most estimates say under $100 million – but are expected to grow to as much as $4 billion by 2005.[98] A recent survey of corporate users found that, although less than one percent of enterprise networks are using Gigabit Ethernet as their primary LAN transport today, nearly one-quarter expect to deploy Gigabit Ethernet within two years.[99]

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offer intra-LATA services."); WorldCom, *Metro Frame Relay Service*, http://www.worldcom.com/us/products/datanetworking/framerelay/metro (WorldCom's Metro Frame Relay service "offers an aggressive price position compared to that offered by LECs. LECs can offer local (intraLATA) service, but they aren't able to cross LATA boundaries or move into other Regional Bell Operating Company (RBOC) territories. WorldCom is in the unique position to provide both interLATA (IXC) and intraLATA frame relay service by capitalizing on our wholly owned nationwide network.").

[95] *See Broadband 2001* at 124 (Gigabit Ethernet (GigE) "Internet access providers connect large enterprises, educational institutions, and small and medium enterprises in large office buildings (MTUs) to the Internet. . . . GigE players also offer LAN-LAN connectivity, also know as transparent LAN services (TLS), to medium and large enterprises. . . . GigE service providers offer wholesale MAN connectivity, providing the infrastructure for high-speed metro backbones."); Cisco, *Technology Brief: Introduction to Gigabit Ethernet*, http://www.cisco.com/warp/public/cc/techno/lnty/etty/ggetty/tech/gigbt_tc.htm (Gigabit Ethernet is typically offered at speeds of 1.25 Gbps).

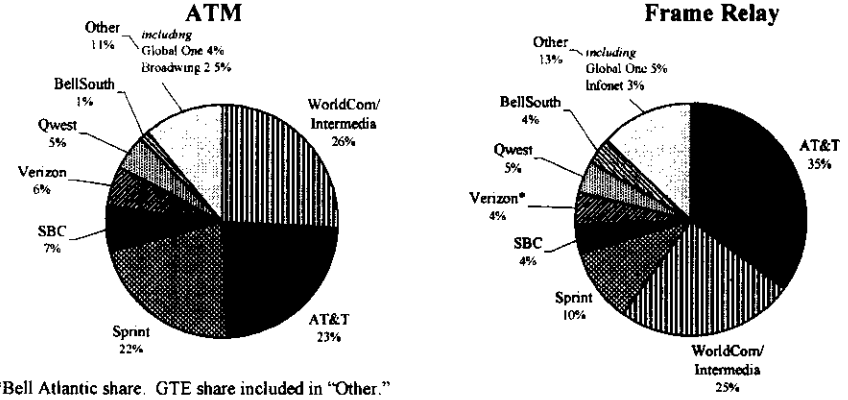
[96] *See, e.g.*, Yipes Communications, *Yipes Announces Nationwide Availability of Instantly Scalable Bandwidth* (Sept. 11, 2001) ("Yipes Communications, Inc. [is] the defining provider of optical Gigabit Ethernet networks"); Telseon Press Release, *Telseon Announces Service Promotion to Drive Metropolitan Gigabit Ethernet Service Adoption* (Apr. 24, 2001) ("As one of the GigE service leaders, Telseon is showing that speed and simplicity of deployment are possible in the metro optical network.") (quoting George Peabody, Aberdeen Group, Vice President and Practice Manager, Communications Infrastructure and Services).

[97] *Stratecast ATM/Frame Relay Report* at 17. *See also* S.M. Milunovich, Merrill Lynch Capital Markets, Investext Rpt. No. 2779422, Tech Strategy; All's Not Quiet on the GIGE Front – Industry Report at *1 (Apr. 10, 2001) (Yipes Communications "has built a 20-city, all-optical, all-GigE network in less than two years," which "offers at least a 5-to-1 cost advantage versus IP over ATM/SONET."); S. Clavenna, *Metro Optical Ethernet*, Lightreading.com (Nov. 13, 2000), http://www.lightreading.com/document.asp?doc_id=2472 (Cogent Communications "has built a network around the sole proposition of providing 100-Mbit/s Ethernet services to tenants of office buildings for $1000 per month, roughly the price of a traditional T1 (1.5 Mbit/s) line."); D. Allen, *Will Gigabit Ethernet WAN Services Make Us Forget About SONET?*, Network Magazine (July 5, 2001) (Telseon has more than 120 Gigabit Ethernet POPs in 20 cities).

[98] *See* L. Cooper & T. Moore, *Corporate America Implementing New Gigabit Ethernet Strategies; Industry Trend or Event*, Communications News (Aug. 1, 2001) (citing Infotech Consulting).

[99] *See id.*

Figure 5. Market Share of Nationwide ATM and Frame Relay Revenues



*Bell Atlantic share. GTE share included in "Other."

Source: R. Kaplan, IDC, *U.S. Packet/Cell-Based Services Market Forecast and Analysis, 2000-2005* at Figures 9 & 31 (2001).

Migration of Traffic to Packet-Switched Networks. Data traffic overtook voice traffic on the phone network in 1998. Since that time, the volume of data traffic has continued to grow much faster than voice.[100] CLECs in particular earn almost half of all their revenues from data services – some $27 billion is the projection for 2002.[101] Data services are the fastest growing source of CLEC revenue.[102] *See* Figure 6 & Table 12.

However it is used, whether for pure "data" (like a spreadsheet) or for data traffic (like messaging) that may in fact compete with voice, the packet switch provides an entry point for CLECs into the provision of switching services in direct competition against ILEC circuit switches. Packet switches compete against circuit switches for all traffic that would otherwise move through a dial-up circuit-switched connection, but that now is conveyed instead to a packet switch directly. And, of course, these packet switches in many cases either are or are capable of being used to provide voice services along with the more traditional data services.

Residential and business customers alike now use e-mail and instant messaging (IM) as direct substitutes for many voice calls.[103] A large and growing fraction of e-mail and IM traffic originates and/or terminates on competitive networks. And even when carried over ILEC networks, such traffic displaces significant usage-sensitive (*e.g.*, per-minute or per-call) revenues that otherwise would be earned.

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[100] *See, e.g.*, William E. Kennard, Chairman, FCC, The Telecom Act at Three: Seeing the Face of the Future, address at the Comptel 1999 Annual Meeting and Trade Exposition, Atlanta, GA (Feb. 8, 1999) ("last year, for the first time, data traffic eclipsed voice traffic on phone lines."); J. Linnehan, Thomas Weisel Partners, LLC, Investext Rpt No. 2295458, Company Report – Level 3 Communications at *3 (Sept. 15, 2000) ("Data traffic has surpassed voice traffic at a three to two ratio."); S. Wadhwani, Dain Rauscher Wessels, Investext Rpt No. 2150061, Avanex Corp. – Company Report at *3 (May 3, 2000) ("While voice traffic is growing at only 3%-5% annually, data traffic is estimated to be growing upward of 30%-50% annually.").

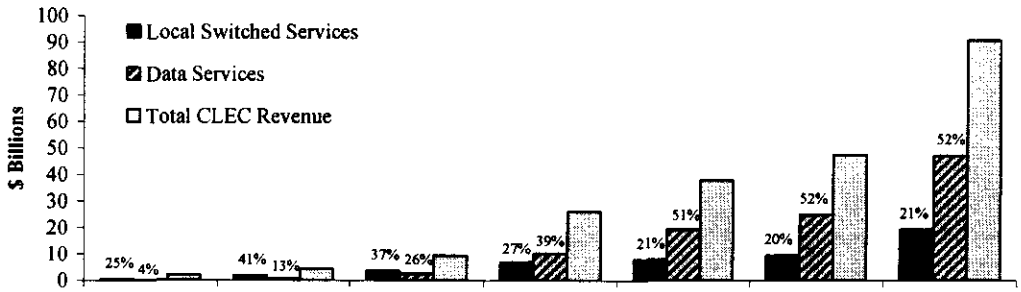
[101] *See NPRG CLEC Report 2002, 15th ed.*, Ch. 3 at Table 10.

[102] *See id.*, Ch. 3 at Table 10; Ch. 2 at Table 8; Ch. 3 at Table 9. This category includes "all data and data-related services (*e.g.*, frame relay, ATM, and Internet access)." *Id.*

[103] As the chairman of AOL's Internet division has stated, "People are not on the telephone anymore." *AOL Promises Open Instant Messenger*, ITworld.com (July 23, 2001), http://www.itworld.com/App/300/IDG010723openaol/.

There are now 900 million e-mail accounts in the U.S. and over 60 million IM users.[104] It is estimated that consumers in the U.S. are sending approximately 3.2 billion e-mail messages[105] and approximately 1 billion IM messages[106] *per day*. If only 10 percent of these 4.2 billion daily e-mail and instant messages substitute for a voice call (of 5 minutes average duration), that is equivalent to about 750 billion minutes per year, or roughly one-third of all local traffic that passes through ILEC networks.[107] And while estimates vary, consumer surveys find that the actual rate of voice substitution is considerably higher. *See* Table 13. E-mail and IM support voice services directly, too, particularly voice messaging services. Voice capabilities are already a standard feature of Instant Messaging.[108] Yahoo!, MSN and AOL all offer voice messaging services over their instant-messaging networks.[109]

Figure 6. CLEC Revenues



Source: New Paradigm Resources Group. *See* Appendix M.

[104] *See* D. Whelan, *The Instant Messaging Market*, American Demographics (Dec. 2001).

[105] *See* T. Shinkle, *Time for a New Look at Email Management*, Computer Technology Review at 48 (June 2001).

[106] *See* R. Gann, *Fast Talking Instant Messaging Software*, Internet Magazine at 140 (Jan. 1, 2001).

[107] *FCC Statistics of Common Carriers, 2000/2001 ed.* at Table 5.8 (Total 1999 Dial Equipment Minutes of 4.414 trillion divided by 2 yields 2.207 trillion conversation minutes; 750 billion/2.207 trillion = 33%).

[108] *See, e.g.*, S. Spanbauer, *Browsing & Beyond: We Pick 13 Must-Have Tools For Today's Internet, Including The Best In Browsers And Add-Ons, E-Mail, Instant Messaging, And Much More*, PC World (Feb. 1, 2002) ("Odigo is the only IM tool we looked at that doesn't let you do PC-to-PC voice chat."); *see also* C. Seper, *'Bots' Add Touch of Humanity, Artificial Intelligence Brings Real Business to Instant Messaging*, Plain Dealer (Dec. 31, 2001).

[109] *See* Yahoo!, *Yahoo! Pager Turns Up The Volume On Instant Messaging, New Voice Chat Feature Allows Users to Talk Live Over the Internet* (May 13, 1999); ICQ Press Release, *ICQ, Inc. and Net2Phone Sign Four-Year, Multi-Million Dollar Internet Telephony Agreement* (July 20, 1999); C. Crouch, *MSN Gives Messenger a Voice*, PC World.com (July 19, 2000); *New MSN Messenger 3.0 Is the Only IM Service to Offer Free Long Distance to the United States and Canada*, M2 Presswire (July 20, 2000); AOL Press Release, *AOL Announces Next Generation of AOL Instant Messenger – Version 4.0 – For Windows and Mac Users* (Apr. 10, 2000).

Table 12. Selected CLEC Data Service Offerings	
CLEC	**Data Offerings**
AT&T	*AT&T Local Frame Relay and ATM Services*: "provide ubiquitous, feature-rich networking options to fit your local (intraLATA) networking needs. . . ideal for companies whose primary business communications needs are heavily concentrated within one or several metropolitan areas (i.e. LATAs)."
Cablevision Lightpath	"Lightpath offers both high quality asynchronous transfer mode (ATM) and advanced frame relay data networks to support demanding high-speed data requirements."
Choice One	"Lucent's 7R/E Packet Solutions . . . will allow Choice One to create a multi-service packet network that integrates voice, video and data services all on a single converged packet network."
Global Crossing	*Frame Relay*: "Link multiple locations with a fast, reliable data transmission network." ATM: "Support multiple applications over a single connection — only ATM technology offers the Quality of Service (QoS) necessary to efficiently support voice, video, and data."
Time Warner Telecom	"National network is built on ATM technology [DS-3, fractional DS-3, DS-1 and fractional DS-1], with facility and equipment redundancies."
US LEC	"US LEC Frame Relay Service is the premier method of fast-packet data communications delivery service in the industry."
WorldCom	*Metro Frame Relay Service*: Available "to more than 350 metropolitan areas serviced by 402 points of presence (POPs) across the nation." "[O]ffers an aggressive price position compared to that offered by LECs. LECs can offer local (intraLATA) service, but they aren't able to cross LATA boundaries. . . . WorldCom is in the unique position to provide both interLATA and intraLATA frame relay service."
XO	"We also have been installing Asynchronous Transfer Mode (ATM) routers and switches in our local network, which will enable us to meet the demands of large, high volume customers."
Sources: See Appendix M.	

Table 13. Growth of E-mail and Instant Messaging
53 percent of consumers use e-mail daily and use it for an average of 29 minutes a day.
IM, online chat, and mobile messaging are used for 15 minutes daily.
37 percent of email users have cut back on their landline calling.
According to the Gartner Group, 60 percent of all real-time online communication – voice or text – will be driven through instant messaging technology.
According to InsightResearch survey: "Forty-seven percent of consumers said they use instant messaging. And of those, 96 percent said they use IM at home and 20 percent use instant messaging at work. . . . Nearly half of all respondents, 49 percent, use instant messaging as a replacement for a telephone call while one third, 35 percent, use it in place of sending an e-mail."
"American workers send and receive approximately 2.2 billion messages every day."
In a study by Vault.com, 45 percent of respondents said e-mail has replaced phone calls.
73 percent of teenagers use the Internet. For one-fifth of them, instant messaging beats the telephone and e-mail as the primary channel for remote communication with friends.
Sources: See Appendix M.

It is now clear that packet-switched networks are capable of and are being used to provide voice service along with traditional data services.[110] Long-distance carriers have been

[110] Both AT&T and WorldCom, for example, have launched retail voice-over-IP (VoIP) services to business customers; this "marked the first instance of two major telecom companies visibly transitioning to all-data networking that supports voice services." M. Smetznnikov, *AT&T Bets on Voice-Over-IP*, Interactive Week (Feb. 5, 2001), http://www.zdnet.com/intweek/stories/news/0,4164,2681792,00.html .

migrating voice traffic to high-speed packet switches for several years.[111] Many CLECs have now begun to migrate their *local* voice traffic onto ATM and Frame Relay networks as well. *See* Table 14. All of the major packet switch manufacturers have developed voice capabilities for their packet switches.[112] Growth for packet-based voice equipment outpaced all other telecom gear in first half of 2001.[113] Analysts now agree that markets for both packet switches and voice-over-packet services will grow rapidly in the next few years.[114]

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[111] *See, e.g.*, A. Lindstrom, *Talkin' 'Bout Next-Generation Telcos* (Level 3 designed its entire long distance network around packet switches from the ground up); T.K. Horan, CIBC Oppenheimer, Investext Rpt. No. 2749262, Telecom Services: Daily Teletimes – Industry Report at *1 (Mar. 1, 1999) ("Frank Ianna, president of AT&T Corp.'s network unit announced that by the end of the year, AT&T plans to stop buying traditional voice switches (circuit switches) in its long-distance network. The company will instead buy predominantly ATM switches for its long-distance network, which will allow data and voice to be carried on the same network more effectively. We note that Sprint also announced that it would stop buying circuit switches after 1999."); Communications Daily (Apr. 14, 2000) (according to MCI Chief Technology Officer Fred Briggs, in April 2000, WorldCom announced that "[a]s part of converging voice and data services, [WorldCom] is planning to roll out this year soft switch or IP switch to handle Internet and voice services on IP backbone.").

[112] *See, e.g.*, C. Stix, Morgan Stanley, Dean Witter, Investext Report No. 8092537, Cisco Systems – Company Report at *3 (July 20, 2001) ("Today over half of Cisco's product lines are voice-enabled."); Lucent Technologies, *Circuit to Packet: Extending the Value of Class 4 and 5 Network Infrastructure in Metro/Edge Networks* at 1, 2 (May 2001), http://www.lucent.com/businesspartners/clp/stories/circuit-to-packet.pdf. ("The migration from circuit to packet is underway. . . . Voice traffic is beginning to move from circuit-switched networks to data networks, including the Internet.").

[113] Communications Daily at 4-5 (Aug. 28, 2001) (according to a Synergy Research Group report, "Voice over Internet protocol (VoIP) equipment totaled $784 million in first half – 40% increase in year . . . Sales of VoIP for service providers grew to $196 million (1.2 million ports) in 2nd quarter, up 81% in year").

[114] *See, e.g., TIA Sees VoIP Nearly Doubling*, Telco Bus. Report (June 18, 2001) (The Telecommunications Industry Association has recently predicted that the voice-over-IP equipment market would nearly double this year to more than $3.3 billion); L. Cauley, *What's Ahead for . . . Phones; Internet Telephony Has Been Slow in Coming, But It's About to Get a Big Boost*, Wall St. J. at R9 (June 25, 2001) (According to Cahners In-Stat Group, carriers looking to offer voice-over-IP services spent about $1.127 billion worldwide in 2000. By 2003 that figure is expected to more than double to $2.607 billion, and again double by 2005 to about $5.855 billion."); E.R. Jackson, U.S. Bancorp Piper Jaffray Inc., Investext Rpt. No. 2442005, Sonus Networks Inc. – Company Report at *2 (Jan. 19, 2001) ("We estimate the market for next-generation voice infrastructure solutions during 2000 to reach more than $1.5 billion. The market is expected to reach well in excess of $5 billion by 2003); L.M. Harris, Josephthal, Investext Rpt. No. 2454183, Sonus Networks Inc.: Initiating Coverage – Company Report at *1 (Jan. 30, 2001) ("While the voice-over-packet switching market in 2000 was probably less than $100 million, we project that it will grow to $250 million in 2001, and to close to $6.5 billion dollars by 2005. At that point, voice-over-packet switching sales could account for 20% or more of total voice switching sales.").

Table 14. CLECs Using Packet Switches To Provide Voice Services	
CLEC	**Status of Voice-Over-Packet Deployment**
AT&T	"AT&T Corp . . . is offering voice over IP (VoIP) retail services for business, allowing the combination of voice, fax and data traffic on a single integrated IP connection managed by AT&T."
Choice One	"Lucent's 7R/E Packet Solutions, which will allow Choice One to create a multi-service packet network that integrates voice, video and data services all on a single converged packet network."
CTC	"CTC has delivered on its promise to having customers utilizing local and long distance voice services on our Cisco Powered packet-based VoIP network by the end of 2000, and its goal of being one of the first carriers to do so."
Global Crossing	"Global Crossing will complete the first phase of its U.S. VoIP network by the end of 2000, placing core VoIP gateway centers in a minimum of 15 additional cities"; "[t]he company plans to transfer its voice traffic from the circuit-switched network to the packet-based network by 2002."
Level 3	"Voice Termination from Level 3 is the first Internet Protocol-based voice product of comparable quality to the switched network because it requires no additional equipment or behavior changes on the part of your customers."
US LEC	Added high capacity ATM packet switches in all of its 23 existing switching centers in the U.S. as part of its "strategic plan to become an IP (Internet Protocol) based CLEC fully integrating voice and data services economically over high bandwidth networks."
WorldCom	"IP Communications" service "will enable businesses to move their voice traffic to an IP network and take advantage of a new generation of multimedia applications."
XO	"XO has begun the first phase of an expansive migration to packet-based switching technology, which is expected to deliver the full range of traditional and enhanced local and long distance services."
Sources: See Appendix M.	

Cable operators, who have been offering cable telephony on their own circuit switches for several years, are now migrating to packet-switched alternatives as well. The upgrades that allow cable companies to offer cable modem services also make it possible for cable to provide high-quality digital telephone service with only a small incremental investment.[115] Uniform industry standards for providing IP telephony over cable are now in place. The North American cable industry has developed and adopted the DOCSIS 1.1 standard.[116] Since the adoption of

[115] *See, e.g., Broadband 2001* at 39 (IP telephony "requires no additional outside plant investment, draws heavily on the core data service infrastructure, and only requires modest incremental equipment investment."); J. Yoshida, *Modem Issues Put Cable Voice-Over-IP Service on Hold* ("cable VoIP service can share the same infrastructure already established for high-speed data services."); *NCTA Cable Telephony Report* at 5 ("VoIP is not only an incremental expense, it utilizes the data path the industry has already built, and should allow for easy software changes and additions to service packages, and innovative combinations of voice, data, and fax services."); *see also* G. Cooke, *Taking the Hybrid Road to IP Telephony*, CED (Dec. 2000), http://www.cedmagazine.com/ced/0012/12e.htm (a "new, hybrid cable IP telephony architecture has emerged. This new architecture enables cable operators with circuit-switched telephony equipment to begin offering converged IP services over their access network without having to forklift all of their existing circuit-switched equipment out of the network.").

[116] *See* Cable Datacom News, *Standards – Cable Modem Standards and Specifications*, http://cabledatacomnews.com/cmic/cmic3.html (The DOCSIS 1.1 specifications add key enhancements to the original standard, such as improved QoS and hardware-based packet-fragmentation capabilities to support IP telephony, and other constant-bit-rate services); CableLabs Press Release, *CableLabs® Certifies Two DOCSIS™ 1.1 Modems and Qualifies Two CMTS, Achieving Breakthrough on Advanced Devices* (Sept. 27, 2001) ("DOCSIS 1 enables cable operators to deliver twice the level of functionality while reducing operating costs by half."); J. Yoshida, *Modem Issues Put Cable Voice-Over-IP Service on Hold* (DOCSIS adds to the previous standard (DOCSIS 1.0, which was designed for cable modem service), "three key elements . . . to support toll-quality telephone calls: upstream packet fragmentation and reassembly techniques, support for a national clock, and an advanced isochronous scheduling system.").

DOCSIS 1.1, the widespread deployment of cable telephony has been awaiting "the availability of cable modems based on version 1.1 of the Data Over Cable Service Interface Specification. DOCSIS 1.1," which was first released in 1999.[117] CableLabs began its certification program for compliant products in 2000; CableLabs certified the first DOCSIS 1.1 compliant cable modems in September 2001.[118] Further tiers of certification are now nearing completion as well.[119]

Upgrading existing cable plant to provide IP telephony costs about $700 per line, or about 15 percent less than circuit-switched telephony.[120] IP telephony also has lower operating costs (by at least 5 percent) than circuit-switched telephony, owing largely to the fact that "it can share a single infrastructure with data."[121] Cable operators are currently conducting trials of IP telephony. *See* Table 15. According to analysts, widespread commercial deployment of IP cable telephony (at least as a secondary line service) will begin in late 2002 or early 2003.[122] Cable

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[117] J. Yoshida, *Modem Issues Put Cable Voice-Over-IP Service on Hold.*

[118] *See* J. Baumgartner, *MSOs Will Make Graceful Transition to DOCSIS 1.1*, CED (Jan. 1, 2002); D. Iler, *Road to PacketCable Passes DOCSIS 1.1*, Multichannel News (Nov. 26, 2001) ("The first domino in standards-based voice-over-Internet protocol (VoIP) gear hitting the market fell in late September when two cable modems and two cable-modem termination systems (CMTSs) won Data Over Cable Service Interface Specification (DOCSIS) 1.1 certification and qualification from Cable Television Laboratories Inc. . . . CableLabs certified cable modems from Toshiba America Information Systems Inc. and Texas Instruments Inc. – whose reference design was used in Toshiba's modem – and qualified CMTSs from Arris Group Inc. and Cadant Inc.").

[119] *See* J. Baumgartner, *MSOs Will Make Graceful Transition to DOCSIS 1.1*, CED (Jan. 1, 2002) ("a variety of cable operators are in the middle of evaluating CMTSs based on or upgradeable to DOCSIS 1.1."); R. Brown & J. Baumgartner, *After the Dust Settles; As Network Upgrades Approach Completion, Service Providers Aim to Launch New Services*, CED (Dec. 1, 2001) (Cox Communications Senior Vice President of Technology Development Chris Bowick: "Over the last six months or so, we've been deep into the evaluation of all the various next-generation CMTS vendors. We have selected two. . . . These are the devices that we will be deploying, or have been deploying for a while, and will continue to deploy through next year in anticipation of becoming fully 1.1-compliant. We'd like to push toward that, toward beginning to get 1.1 compliant through the end of next year."); D. Iler, *Road to PacketCable Passes DOCSIS 1.1*, Multichannel News (Nov. 26, 2001).

[120] *See, e.g., JP Morgan Cable Industry Report* at 46; *see also* AT&T Broadband, *Investor Presentation* at 37 (July 2001) (AT&T estimates that providing primary line VoIP telephony would involve costs totaling $530-$620 per customer, including $230-$270 for switching and other outside equipment and $300-$350 for customer equipment, while circuit switched primary line telephony would cost $675); *JP Morgan Cable Industry Report* at 51 ("IP benefits from substantially lower costs in the centralized equipment that resides in the headend.").

[121] B. Michael, *Cable VoIP*, Computer Telephony at 36 (Aug. 1, 2000). *See also JP Morgan Cable Industry Report* at 46 ("IP's operating costs will probably run 5% less than those for circuit voice."); *id.* at 54 ("IP voice offers the promise of using a single hardware platform, support system, and staff for both data and telephony services," which "not only lowers capital and operating costs, but also simplifies operations and provisioning."); Nortel Networks, White Paper, *The Cable Telephony Opportunity; Increasing Profits With Integrated Telephony and Data Services*, http://www.gel.ulaval.ca/~mlecours/19504/Modem-cable/NortelCM.pdf. ("By delivering IP telephony and data services over a single DOCSIS cable modem system, headend and customer premise equipment expenditures are reduced. Additionally, operating efficiencies are gained by managing a single telecommunications platform, rather that multiple logical networks. The use of common equipment also simplifies customer provisioning and installation processes.").

[122] *See, e.g.*, R.A. Bilotti, Morgan Stanley, Dean Witter, Investext Rpt. No. 8202634, Cable: The Past Is Prologue to the Future – Industry Report at *5 (Oct. 5, 2001) ("We expect the cable operators to begin offering IP telephony in 2002/2003"); M. Paxton, *Cable Telephony – Moving Slowly But Surely*, CED (Jan. 2002), http://www.cedmagazine.com/ced/2002/0102/id6.htm ("most [MSOs awaiting IP telephony] remain confident that by late 2002/early 2003, cable telephony will be an important part of their service menu"); J. Baumgartner, *No Large VoIP Roll-Outs Until Late 2002*, CED at 10 (Jan. 1, 2002) ("[I]t's expected that cable operators won't rollout IP telephony in

operators are expected to deploy primary line IP cable telephony service shortly thereafter.[123] Analysts expect that there will be between five and seven million cable IP telephony subscribers by 2006.[124]

Table 15. Cable IP Telephony

Cable Operator	IP Telephony Trials	Plans For Future Deployment
Time Warner	Portland, ME Rochester, NY	As of March 2001, Time Warner planned to attract 1,000 IP voice customers by September 2001, and to then monitor usage and calling patterns before embarking on a full deployment. IP telephony "will be offered some time [in 2002] in the [Tampa] bay area and central Florida."
AT&T Broadband	Boulder, CO	"We're looking to deliver IP as quickly as possible." (Jim Wood, vice president of advanced technology, Sept. 2001)
Cox	planned	"Our strategy is to launch circuit-switched technology in our markets, and we've done that. . . . IP telephony is nearly ready for prime time. We're watching it very closely." (Tom White, Director of Marketing, Apr. 2001) "Cox is confident that IP telephony will add great value for our customers . . . We envision circuit switched and IP services will coexist in all of our networks." (Jim Robbins, CEO, May 2001)
Comcast	Alexandria, VA Union, NJ (completed) Philadelphia, PA	Customers could see IP telephony service in 2002. (Steve Craddock, senior VP of new media, Apr. 2001)
Adelphia	Buffalo, NY	As of June 2000, Adelphia expects to launch commercial service first in Buffalo. Other markets will include Pittsburgh and its suburbs, Florida, Colorado Springs, Southern California, and other areas served such as Vermont, Virginia and Ohio.
Cablevision	Long Island, NY	Cablevision's digital and interactive television service, iO, is currently available to 550,000 homes in Long Island; the company plans to roll out iO throughout its service area, passing 4.7 million homes. The iO digital box will enable the provision of IP telephony to residential subscribers. Cablevision is currently testing this service in 300 homes and intends to begin commercial deployment in 2002.
Charter	Wausau, WI St. Louis, MO	Charter plans to begin IP-telephony tests in 2002. Charter has already conducted two technical VoIP trials; the company will launch a marketing trial of both primary and secondary line IP service in Stevens Point, Wisc.

Sources: See Appendix M.

earnest until the latter part of 2002. Until then, we'll probably see more lab trials and pilot efforts in the field to make certain that everything works as advertised and that it's a service with consumer demand"); A.B. Green, Lehman Bros. Inc., Investext Rpt No. 8302989, Broadband Access Technologies at *3 (Dec. 14, 2001) ("Our sense from the cable show is that operator interest and deployments of cable telephony are a likely story for the second half of 2002."); J. Duffy, *DOCSIS Compliance Delaying Cable IP Telephony*, Network World (Aug. 13, 2001) ("It will be late 2002 or early 2003 before widespread deployments of IP-based cable telephony occur, the research firm [Cahners In-Stat Group] predicts.").

[123] *See, e.g., JP Morgan Cable Industry Report* at 46 ("we suspect that most MSOs will deploy primary-line IP voice in 2004 or 2005"); *Strategis Group U.S. IP Cable Telephony Report* at 52-53 (predicting that AT&T, Cox, Adelphia, Comcast, and Charter will begin deploying primary line IP telephony in late 2003/early 2004).

[124] *See id.* at Table 3.9 (predicting 7.36 million IP telephony lines by 2006); *Forrester Sizing US Consumer Telecom Report* at 10-12 ("[B]y 2006, [cable companies] will reap the rewards of conversion to IP – an increased set of offerings at lowered costs – in the form of 4.8 million new packet lines.").

There are strong incentives for CLECs and cable operators to migrate to packet switching.[125] Packet switches serve the most dynamic, rapidly growing sector of the industry – the data sector. They are much more compact than circuit switches,[126] and they are much cheaper to purchase and deploy.[127]

A new generation of "softswitch" packet switches is now accelerating all of these trends.[128] They are fast enough to switch voice, data, video, and other forms of traffic; they are thus far more compact and efficient than the arrays of media-specific hardware that they can displace. Equipment manufacturers, CLECs, and industry analysts all agree that these new switches can serve as complete "replacements" for Class 5 switches. *See* Appendix J, Tables 1 & 2. Numerous CLECs have already deployed softswitches. *See* Appendix J, Table 3. The Yankee Group expects worldwide sales of softswitches to rise from $16 million in 1999 to $824 million in 2003.[129] Frost and Sullivan predicts that "providers will invest more than $39 billion in softswitch technology by 2006 and will realize $85 billion for services delivered using the technology that year."[130]

C. Wireless Switches as Substitutes for Circuit Switches.

Wireless switches substitute for wireline switches at the margin, in much the same way as packet switches do. The marginal buyer of wireline service is the residential buyer of second-

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[125] *See, e.g.*, A. Lindstrom, *Talkin' 'Bout Next-Generation Telcos* ("New business models based on the use of IP-oriented switches . . . enable gross margins in the 60 percent-plus range and the ability to provide differentiated offerings."); J. Boyd, *The End of the Central Office*, http://www.internetwk.com/infastructure/infra081400-3.htm (Aug. 14, 2000) ("The huge price differences between Class 5 switches and new convergent platforms will allow more start-up CLECs like ACD.net to enter the market.") (citing Andrew Clay, analyst, Aberdeen Group).

[126] *See, e.g.*, E.R. Jackson, U.S. Bancorp Piper Jaffray Inc., Investext Rpt. No. 2267558, Sonus Networks Inc.: Initiating Coverage – Company Report at *4 (Aug. 21, 2000) (packet switches "can result in a reduction of up to 90% in equipment space requirements.").

[127] *See, e.g., id.* ("packet telephony offers potential reductions of up to 50% in switch per-port costs" compared to traditional circuit switches." This "[f]aster, cheaper, smaller, and more versatile switching equipment is transforming the central office."); Wall St. Transcript Corp., Investext Rpt. No. 2003080, Analyst Interview: Telecommunications – Industry Report at *3-*4 (Sept. 22, 2000) (Trent Spiridellis, Principal and Senior Equity Research Analyst, Banc of America Securities: the price performance of an IP network "doubles . . . every 20 months.").

[128] *See, e.g.*, M. Reddig, *Top 10 Advances in Switching* ("The most important development in switching over the past 3 years has been the rapid development, innovation and standardization of softswitches.") (quoting Constantine Gavrilidis, Broadriver Communications."); *id.* ("Three years ago, softswitches were just a concept. Today they are an integral part of an important milestone in the history of telecommunications."); M. Johnston & D. Pappalardo, *WorldCom Sees Promise in Move to Softswitches*, Network World (Jan. 29, 2001) (As WorldCom's Chief Technology Officer has noted, softswitches are "not pie in the sky," but rather "stuff that we are deploying *today*.").

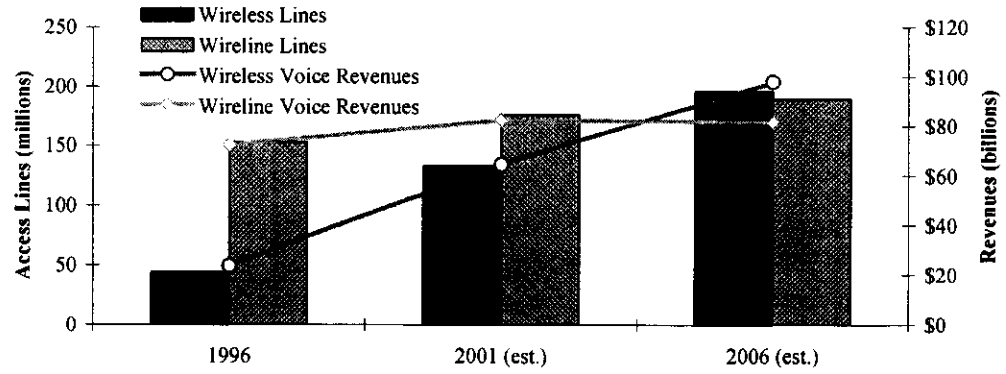
[129] *See* P. Korzeniowski, *Pieces of Concern – The Communications Market Is One Big Puzzle, and Clecs Are Scrambling To Find the Right Fit*, tele.com (May 29, 2000) (citing Yankee Group).

[130] M. Reddig, *Softswitches Emerge from the Shadows* (citing Frost & Sullivan, World Softswitch Markets). *See also id.* (citing estimate by The Pelorus Group, *Softswitches and Broadband Switching: The New Environment* that "the softswitch market will grow from a revenue base of $200 million in 2000 to roughly $4 billion by 2004.").

line service. And as "margins" go, this is a big one: approximately 26 percent of U.S. residential customers buy second-line service from a wireline phone company.[131]

As of February 2002, there were an estimated 130 million wireless subscribers in the United States – up from 34 million at the end of 1995[132] – as compared to the approximately 190 million users of switched landline telephone service.[133] Two in five Americans – with all adults and children included in that count – have a mobile phone.[134] Some twenty million new subscribers are being added annually.[135] Wireless carriers are adding subscribers much faster than their wireline counterparts – in percentage terms, and in absolute terms, too.[136] *See* Figure 7.

Figure 7. Wireless vs. Wireline Growth



Source: JP Morgan H&Q. *See* Appendix M.

All of this wireless traffic is *switched* traffic. Wireless carriers other than those affiliated with Bell companies have deployed a total of more than 950 circuit switches nationwide. *See* Appendix F.[137] Many of the switches that wireless carriers are using are indeed the same switch types that CLECs are using – for example, the Lucent 5ESS, Nortel DMS 100, and Ericsson AXE-10.[138]

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[131] *See Forrester Sizing US Consumer Telecom Report* at 2.

[132] *See CTIA's Semi-Annual Wireless Industry Survey Results*; CTIA, *CTIA's World of Wireless Communications*, http://www.wow-com.com (131 million current U.S. wireless subscribers as of Feb. 12, 2002).

[133] *See CSFB 3Q01 CLEC Vital Signs Review* at Exh. 9; *see also FCC Local Competition Report, Feb. 2002 ed.* at 1.

[134] *See* Michael Powell, Chairman, FCC, *Consumer Policy in Competitive Markets*, remarks before the Federal Communications Bar Association, Washington, D.C. (June 21, 2001).

[135] *See CTIA's Semi-Annual Wireless Industry Survey Results.*

[136] *Compare FCC Statistics of Common Carriers, 2000/2001 ed.* at Table 4.10 (total switched access lines and residential switched access line growth, 1995-2000) *with CTIA's Semi-Annual Wireless Industry Survey Results* (estimated wireless subscribers, 1995-2000).

[137] These figures are conservative, because they are drawn from public sources or from the necessarily limited data available to the BOCs.

[138] *See, e.g.*, Lucent Technologies, *Switching Solutions, Switching, 5ESS Switch*, http://www.lucent.com/products/solution/O,,CTID+2002-STID+10055-SOID+935-LOCL+1,00.html ("The 5ESS® switch can deploy all

At the end of 2001, wireless calls already accounted for an estimated 12 percent of all U.S. phone calls.[139] There were approximately 200 billion billable minutes of wireless use in the first half of 2001, up 77 percent from June 2000, and up 34 percent from December 2000.[140] Wireless networks now switch at least one-quarter of the amount of traffic as wireline networks.[141] And wireless minutes of traffic are growing at over 60 percent per year, while landline minutes are growing at "low single digits."[142]

A second very large margin for which wireless switches compete is switched access traffic. In addition to completing local calls, local switches serve the second function of providing switched access to long-distance networks. Local access revenues represent approximately 14 percent of all local service revenues;[143] long-distance calling minutes (*i.e.*, access minutes) represent about one-quarter of all switched minutes on local plant.[144] Wireless plant certainly competes directly against wireline plant here, too.

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types and combinations of services from a single platform including wireline, wireless, voice and data."); Nortel Networks, *Products, Services & Solutions, DMS Switching Portfolio, DMS-100 Wireless Switching System*, http://www.nortelnetworks.com/products/01/dms100w/index.html (The DMS-100 "offers a flexible and cost effective way for a service provider to establish a single point of presence in both traditional wireline and wireless markets, as well as new data and internet telephony markets."); Alcatel, *Products and Services, Alcatel 1000 Multimedia Multiservice Exchange*, http://www6.alcatel.com/products/ (The Alcatel 1000 MM "handles any combination of fixed and mobile application.").

[139] *See* V. Bajaj, *Daytime Calling Clogs Spur Wireless Companies to Expand Night Minutes*, Dallas Morning News (Dec. 13, 2001) (citing David Bornowski, AT&T Wireless Services Inc.'s vice president/general manager for Texas and Louisiana). This number is projected to increase to nearly 50 percent by 2005. *See The Bull Market Report Daily*, www.bull-market.com (Jan. 12, 2001), http://www.bull-market.com/daily/Jan01/011201.htm. In terms of talk minutes, wireless is projected to account for over 40 percent of all conversation minutes by 2005. J. Sarles, *Wireless Users Hanging Up on Landline Phones*, S.F. Bus. Times (Mar. 23, 2001).

[140] *See* R. Whickham, *Don't Kid Yourself*, Wireless Review (Dec. 1, 2001), http://industryclick.com/magazinearticle.asp?releaseid=9715&magazinearticleid=136835&siteid=3&magazineid=9; *see also* CTIA, *Telephia Study Finds Outstanding Wireless Network Performance While Industry Experiences Rapid Growth*, http://www.wow-com.com/articles.cfm?ID=553 ("Minutes of use increased by 75% last year - from 147 billion minutes used in 1999 to 259 billion minutes used in 2000.").

[141] Wireline networks switch approximately 4.4 trillion local dial equipment minutes ("DEMs") per year, and there are two DEMs counted for each conversation minute, resulting in approximately 2.2 trillion originating and terminating minutes. There are 130 million wireless subscribers and the average subscriber uses 339 minutes per month (4,068 per year) on her wireless phone, resulting in approximately 529 billion originating and terminating wireless minutes per year. Both totals include toll minutes. *See* L.F. Carvalho, Morgan Stanley, Dean Witter, Investext Rpt. No. 8285600, Wireless Services: Industry Outlook: Life After 50 – Industry Report at *5 (Nov. 28, 2001) (average of 339 monthly MOUs per wireless subscriber in 2001); CTIA, *CTIA's World of Wireless Communication*, http://www.wow-com.com (130 million wireless subscribers); *FCC Statistics of Common Carriers, 2000/2001 ed.* at Table 5.8 (4.4 trillion Dial Equipment Minutes; "two [dial equipment minutes] are counted for every conversation minute").

[142] *See 3g Rollouts Inch Along, But Kagan Research Indicates Wireless Minutes Roaring Ahead, Set to Dominate Telecom Landscape by 2005 Leading Executives to Debate Market Demand, Technology and Financing at Kagan's Wireless Telecom Summit May 2-3 in New York*, Bus. Wire (Apr. 27, 2001).

[143] *See FCC Telecommunications Industry Revenues, 2002 ed.* at Table 2.

[144] *See FCC Statistics of Common Carriers, 2000/2001 ed.* at Table 5.8 (3.4 trillion local dial equipment minutes, both originating and terminating); *id.* at Table 2.5 (790 billion interLATA billed access minutes, both originating and terminating).

At least twenty million wireless customers (and counting) have plans that do not charge extra for long-distance.[145] The average price of a wireless long distance call is comparable to the average price of a long distance call made via wireline.[146] Many wireless carriers heavily market the "free long-distance" aspects of their service. Analysts report that "[t]he bundling of long distance calling at price points that are perceived as 'nearly free' to consumers is already making wireless long distance calling a more cost-effective alternative to wireline long distance calling to many wireless consumers."[147] Thus, "wireless continues to take share from wireline local and long distance usage."[148] AT&T recently noted that its wireline long-distance minutes of use were down about 10 percent, while its wholesale wireless long-distance traffic was running up about 35 percent.[149]

While wireless-wireline competition starts at the margin, it by no means ends there. Wireless is increasingly competitive with core primary-line wireline services. When the comparison is made between equivalent bundles of service, it is clear that wireless services are now price-competitive with wireline. Almost all wireline CLECs focus on selling bundles of service – not just basic access, but bundled long-distance and additional features as well.[150] And so do almost all wireless carriers. And so do most of the ILECs themselves. Regulation does require ILECs to offer unadorned, basic, local service at a very low price to all residential customers. But the vast majority of wireline customers buy much more – long-distance service, to begin with, which generates additional local-carrier revenues by way of access charges. And often, as well, other value-added features like call waiting, voice mail, and caller ID. A November 2001 Gartner Dataquest study concludes that wireless calling prices are already "competitive with, and in some case better than, wireline calling rates."[151]

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[145] *Sixth CMRS Report* at 32-33. The Strategis Group estimates that this number will grow to 90 million in 2005. *See* A. Backover, *AT&T Loss Reflects Long-Distance Shift Consumers Turn to Calling Cards, Wireless*, USA Today at 3B (Jan. 30, 2001).

[146] For example, Cricket offers long distance service at 8 cents per minute without monthly service charges or minimum usage charges. *See* Cricket, *Denver and Northern Colorado*, http://www.cricketcommunications.com/Denver_Colorado_2.asp; *see also* M. Rollins, Salomon Smith Barney, Investext Rpt. No. 2421667, Wireless by the Minute: Reviewing the Wireless Economic Model – Industry Report at *4 (Jan. 3, 2001) ("With buckets of minutes, wireless customers have a marginal cost of zero relative to wireline, which generally has a marginal cost of $0.05-$0.15 per minute.").

[147] *IDC Wireless Displacement Report* at 20. *See also* L.R. Mutschler, Merrill Lynch Capital Markets, Investext Rpt. No. 8247725, Sprint PCS Group – Company Report at *4 (Oct. 31, 2001) ("[T]he free long distance option in the Sprint PCS plan should make them attractive to subscribers that are interested in replacing wireline long distance minutes with wireless minutes.").

[148] M. Rollins, Salomon Smith Barney, Investext Rpt No. 8223022, Sprint PCS Group – Company Report at *4 (Oct. 18, 2001).

[149] *See* A. Quinton, Merrill Lynch Capital Markets, Investext Rpt No. 8232517, AT&T Corp. – Company Report at *5 (Oct. 24, 2001).

[150] *See, e.g.*, G.P. Miller, *et al.*, Jefferies & Co., Investext Rpt. No. 2918156, Telecom Services Weekly Update – Industry Report at *11 (Aug. 9, 1999) ("The CLECs have [] built much of their platform on offering competitively priced bundled and personalized service.").

[151] *Gartner U.S. Consumer Telecommunications and Online Market Report* at 33.

Wireless prices continue to decline rapidly – by as much as 10 to 20 percent a year in recent years.[152] While the length of the average wireless user's local call has increased, the average local monthly wireless bill has fallen from $97 in 1987 to $45 in 2001.[153] Analyst IDC attributes the dramatic growth in wireless usage, particularly in home and business locations that provide wireline access too, primarily to the fact "that wireless service pricing is rapidly approaching wireline service pricing."[154] At prices now in effect, wireless "is viewed as a cost-effective and compelling alternative to wireline."[155] Numerous analysts have reached the same conclusion.[156]

The Commission itself has agreed with this assessment in its July 2001 *Sixth CMRS Report*. It found that the wireless phone has "become a mass-market consumer device," that most wireless customers use their phones "primarily for personal calls," and that three in ten wireless users would prefer to give up their landline phone, if forced to choose, and that number rises to almost one in two among younger users.[157] The Commission's Report went on to discuss wireless services that are specifically being marketed as alternatives to wireline service.[158] Citing a Yankee Group survey, the report also found that at a quite sizable number of consumers – about 3 percent of wireless subscribers – have now abandoned wireline – in favor of wireless – entirely, "rely[ing] on their wireless phone as their only phone."[159] A more recent *USA Today*/CNN/Gallup poll found that 18 percent of cell phone users "use cell phones as their primary phones."[160]

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[152] *See, e.g., Sixth CMRS Report* at 6.

[153] *CTIA's Semi-Annual Wireless Industry Survey Results*.

[154] *IDC Wireless Displacement Report* at 11.

[155] *Id.* at 19.

[156] *See, e.g., Gartner U.S. Consumer Telecommunications and Online Market Report* at 41 (Gartner Dataquest: "Average mobile per-minute pricing will continue to decrease," with an "increased cross-elastic impact on wireline services."); *see also* Argus Research Company and Foliofn, *Sector Outlook: Telecomms Second Quarter 2001* (Second Quarter 2001), http://www.foliofn.com/content/forum/research/01Q2Telecom.pdf (Argus Research: "Pricing for wireless service has fallen to levels comparable with wireline service in many areas of the country, and more and more consumers are opting for wireless as their primary telecom connection."); J. Moran, *Phones: Cheaper and Better*, Hartford Courant at L28 (Feb. 25, 2001) ("The cost of wireless voice will continue to decline," [Peter Firstbrook, META Group research analyst] said. "You'll finally have competition for the [local phone companies]. I think we're at the transition right now where wireless prices are reaching parity with wireline.").

[157] *Sixth CMRS Report* at 32.

[158] *See id.* at 33-34.

[159] *Id.* at 32 (citing J. Sarles, *Wireless Users Hanging Up on Landline Phones*, Nashville Bus. J. (Feb. 2, 2001)). The Commission noted that CTIA estimated that this number "could be as high as 5 percent." *Sixth CMRS Report* at 32 n.207 (citing *Consumers Replacing Landline Phones with Wireless*, Knight Ridder/Trib. Bus. News (Jan. 10, 2001).

[160] M. Kessler, *18% See Cell Phones as Their Main Phones*, USA Today (Jan. 31, 2002).

III. INTEROFFICE TRANSPORT

The interoffice transport UNE comprises links between ILECs' and requesting carriers' wire centers or switches, and between ILEC switches.[1] A "wire center" is an end office where local loops terminate at an ILEC switch.[2] Interoffice transport does not include transport between an ILEC or CLEC switch and a customer.

The provision of interoffice transport is now highly competitive. The first competitors entered urban markets in 1985, and they have been laying competitive fiber optic networks ever since. The Commission first directed ILECs to provide collocation to competitive access providers in 1992.[3] Today, competitors have established fiber connections in a large fraction of BOC wire centers, which serve a significant percentage of BOC access lines. Many of the competitive transport facilities that CLECs have deployed are used to provide special access services; competitors now earn between 28 and 39 percent of all special access revenues.

As detailed below, it clearly is economical for competitors to serve an even larger number of wire centers with their networks than they currently do. With each additional mile of competitive fiber that gets deployed, the marginal cost of extending the network to reach an additional wire center gets lower. And the rise of the Internet has made it all the more attractive for CLECs to extend their fiber networks to ILEC end offices. Data connections generate a lot more traffic than voice calls do; the total volume of data traffic overtook voice traffic in 1998.[4]

A. Fiber-Based Collocation.

CLECs that provide competitive transport typically do so by collocating their own transmission equipment in an ILEC central office and connecting that equipment to their own fiber-optic network. This "fiber-based collocation" supplies the simplest and most unambiguous indicator of the extent of competition in the transport market, albeit a very conservative one that sharply underestimates the full extent of competition.

With few exceptions, competitively supplied transport begins in a CLEC collocation cage.[5] At the time of the last UNE review, the data required to determine where CLECs had

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[1] *See* 47 C.F.R. § 51.319(d)(1)(i) (defining dedicated transport as "transmission facilities . . . between wire centers owned by incumbent LECs or requesting telecommunications carriers, or between switches owned by incumbent LECs or requesting telecommunications carriers."); *id.* § 51.319(d)(1)(iii) (defining shared transport as "transmission facilities . . . between end office switches, between end office switches and tandem switches, and between tandem switches, in the incumbent LEC network.").

[2] *See Newton's Telecom Dictionary* 995 (16th ed. 2000). Wire centers vary widely in size, from fewer than 500 lines in rural areas, to over 300,000 in the most densely populated urban areas.

[3] *See Expanded Interconnection with Local Telephone Company Facilities*, Report and Order and Notice of Proposed Rulemaking, 7 FCC Rcd 7369 (1992).

[4] *See* Section II, note 100.

[5] *See, e.g.*, W.T. Scott, *et al.*, ING Baring Furman Selz LLC, Investext Rpt. No. 2787890, *Telecommunications/Fiber Vs. Fiberless* (Sept. 30, 1998) (quoting then-WinStar CEO, Bill Rouhana: "The fundamental underpinning of the strategy of most fiber-based companies in the industry today is that we will build to a central office, and we will co-locate with a regional bell operating company."); *id.* (quoting Allegiance Telecom CEO

obtained *fiber-based* collocation was not available.[6] It is today. The Commission's August 1999 *Pricing Flexibility Order* makes the presence of fiber-based collocation the trigger for pricing relief for special access services, and ILECs have therefore begun to compile such data systematically.[7]

As shown in Table 1, fiber-based collocation is now widespread. As of year-end 2001, *one or more* CLECs had obtained fiber-based collocation in 13 percent of the wire centers served by the Bell companies, which contain 54 percent of the business lines and 44 percent of all access lines served by the Bell companies. *See* Table 1. There also are multiple CLECs with fiber-based collocation in a large number of BOC wire centers, which contain a significant share of BOC access lines. *See id.*

Table 1. Competitive Interoffice Transport by Region

	Percentage of Wire Centers and Access Lines Served by:											
	1 or more fiber-based CLEC collocation nodes			2 or more			3 or more			4 or more		
	% Bus. Lines	% Total Lines	% WC	% Bus. Lines	% Total Lines	% WC	% Bus. Lines	% Total Lines	% WC	% Bus. Lines	% Total Lines	% WC
Verizon	55	44	12	37	25	5	28	17	3	17	10	2
SBC	50	41	13	35	25	7	23	15	4	15	9	2
BellSouth	62	53	19	52	43	13	43	34	9	34	26	6
Qwest	56	45	13	40	28	7	27	18	4	19	12	3
Total	**54**	**44**	**13**	**38**	**28**	**7**	**28**	**19**	**4**	**19**	**12**	**3**

In large metropolitan areas the totals are even higher. For example, in the 25 largest MSAs served by each BOC, an average of *one or more* CLECs had obtained fiber-based collocation in 35 percent of the wire centers served by the Bell company in those MSAs (containing 61 percent of all access lines within those MSAs). *See* Table 2. And, again, there

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Royce Holland: "We enter the market and put in switches, routers, both central office and frame-relay switches. We co-locate in a huge number of COs. We've targeted over 500 central offices to be in within the next few years. It represents a huge addressable market and then we go out and lease capacity initially, and as we reach the crossover point in terms of traffic, we either lease dark fiber or overbuild it. For instance, in New York, the crossover point is 40,000 lines. We have already moved to stage two, in which we acquired dark fiber from Metromedia Fiber Network."); KMC Telecom Holdings Inc., Form 10-K (SEC filed Apr. 17, 2001) ("[i]n all of our operational markets, we have completed our backbone construction connecting the market's central business district with outlying office parks, large institutions, the locations of long distance carriers' transmission equipment and major incumbent local exchange carrier central offices."); Adelphia Business Solutions, Form 10-K (SEC filed Apr. 2, 2001) (Adelphia claims that "[t]he broad deployment of fiber optic cable in Adelphia Business Solutions' markets typically enables connectivity among the Company, the ILEC central offices and the Company's customers."); Network Plus, Form 10-K at 13 (SEC filed Mar. 30, 2000) (Network Plus's fiber provides connections for the company's "co-location footprint.").

[6] As one analyst report notes, "detailed information on actual fiber deployment on an industry wide basis is not available." *Broadband 2001* at 92. To analyze competitive fiber, it is therefore necessary to "build a ground-up view of where such fiber is or is likely to be deployed." *Id.*

[7] *See Pricing Flexibility Order* ¶¶ 81-86, 147-152.

are multiple CLECs with fiber-based collocation in a large number of BOC wire centers in the largest MSAs, which contain a significant percentage of BOC access lines. *See id.*

Table 2. Competitive Interoffice Transport in the 25 Largest MSAs Served by Each BOC								
	Percentage of Wire Centers and Access Lines Served by:							
	1 or more fiber-based CLEC collocation nodes		2 or more		3 or more		4 or more	
	% Lines	% WCs	% Lines	% WCs	% Lines	% WCs	% Lines	% WCs
Verizon	58	35	36	16	25	10	16	6
SBC	61	35	37	18	23	10	13	5
BellSouth	69	37	57	27	47	20	35	14
Qwest	60	32	38	19	25	11	18	7
Total	**61**	**35**	**40**	**19**	**27**	**12**	**18**	**7**

It is clearly economical for competitors to deploy fiber in an even larger share of wire centers than they currently serve. Some 30 percent of all wire centers contain 5,000 or more business lines, and those wire centers contain 84 percent of all business lines.[8] In those quantities, independent analysts have found that voice lines readily generate traffic in volumes sufficient to justify competitive fiber-optic transport.[9] And the actual experience of CLECs in the marketplace bears this out.

As shown in Table 3, one or more CLECs has obtained fiber-based collocation in nearly half of BOC wire centers with 5,000 or more business lines. *See* Table 3. And in wire centers with larger numbers of business lines, it is even more likely that at least one CLEC has obtained fiber-based collocation in that wire center. *See id.*

Table 3. Competitive Interoffice Transport in Large Wire Centers																
	Percentage of all wire centers with *X* or more business lines that contain *Y* or more CLECs with fiber-based collocation:															
***X*=**	**5,000**				**10,000**				**20,000**				**30,000**			
***Y*=**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Verizon	51	26	16	9	66	39	27	15	78	65	50	31	93	84	69	41
SBC	38	21	11	6	51	32	18	10	73	53	41	19	80	64	45	28
BellSouth	66	51	37	25	81	75	62	47	91	91	86	75	100	100	100	100
Qwest	48	28	16	11	65	41	24	17	86	68	48	33	94	76	64	42
Total	**48**	**28**	**17**	**10**	**61**	**41**	**27**	**17**	**78**	**62**	**49**	**30**	**87**	**74**	**58**	**39**

[8] *See Broadband 2001* at 96.

[9] *See, e.g., Broadband 2001* at 95 (Central offices "with more than 5,000 business lines . . . require [CLECs to gain] no more than 8% share [to break even] and therefore are well within the 'sweet spot' of even multiple CLECs per CO."); *see also id.* ("As might be expected, it is apparent that businesses residing with larger central offices spend up to one-third more on average per business per month than those businesses in smaller central offices.").

A fiber-based collocation test for the availability of competitive transport certainly provides a reliable indicator of which ILEC wire centers are served by competing fiber networks. It is worth emphasizing, however, that this test takes no account of the considerable amount of traffic that now bypasses ILEC wire centers completely. As one appellate court has noted, the fiber-based collocation metric "fails to account for the presence of competitors that . . . have wholly bypassed incumbent LEC facilities."[10]

This is all the more true because the ILEC wire center is no longer the only – or even the principal – point of traffic concentration. So if it is economical for a CLEC to run competitive fiber to reach an ILEC wire center, it is often economical to extend the fiber, directly to datacom hotels, large business customers, data ISPs, wireless carriers, cable headends, and countless other points of traffic concentration.[11]

Many private customers also now generate sufficient quantities of traffic to justify their own fiber optic connections. As discussed in Section IV.A, there are now direct CLEC fiber connections to tens of thousands of buildings in the U.S. – buildings that house a substantial fraction of all business customers.

CLEC networks also converge today at many other points of high traffic concentration, including interexchange carrier POPs and Network Access Points (NAPs). "Collocation hotels" – like those operated by Switch & Data, Cable & Wireless (formerly Exodus Communications), Global Switch, and Metro Nexus – create additional points of traffic concentration. These centers provide large (typically 10,000-50,000 square foot), high-security facilities to house servers, data storage equipment, and the network interface equipment used by telecom carriers and ISPs.[12] They give multiple CLECs and IXCs points at which to station their equipment and interconnect their networks.[13] Many of them are located right on the doorstep of existing ILEC wire centers.[14] In terms of how much traffic they originate and terminate, these facilities are as large as – and often much larger than – ILEC wire centers.[15] Data traffic at these centers is now

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[10] *WorldCom v. FCC*, 238 F.3d. 440, 462 (D.C. Cir. 2001) (quoting *Pricing Flexibility Order* ¶ 95). This framework also is conservative because it examines only fiber-based collocation, even though competitive carriers have obtained thousands of collocation arrangements that, although not fiber based today, could easily be modified to connect to third-party fiber.

[11] *See, e.g., Wall Street Transcript Corp. Interview, John Peters – Sigma Networks* (John Peters, CEO, Sigma Networks: "[W]e've targeted our network to address the interconnection needs principally between all of the major sources and links of data traffic in the metro. We've targeted the major carrier hotels, the major data centers, the Internet backbone connection points 'the MAEs, the PAIXs' and the broadband backbone networks.").

[12] *See* D. Culver, *Construction Boom for Colocation.*

[13] *See* R. Duran, *Checking into Telecom Hotels*, Bus. Xpansion J. (Feb. 2001), http://www.bxjonline.com/issues/feb2001/telecom_hotels.asp.

[14] *See* D. Culver, *Construction Boom for Colocation* (collocation hotels provide "high-security facilities operated by independent companies that put telecom gear as close as possible to incumbent central offices without actually being there.").

[15] *See, e.g.*, R.J. Sherman, Janney Montgomery Scott, Investext Rpt No. 2121566, Exodus Communications – Company Report at *2 (Apr. 4, 2000) ("It is estimated that 50% of all Internet traffic flows from Exodus' data centers."); F. Billimoria, *et al.*, Hambrecht and Quist Inc., Investext Rpt No. 2724275, Exodus Communications – Company Report at *2 (Nov. 20, 1998) ("The company estimates that 10-12% of traffic that is carried over the Internet

growing at 100 percent a year, "and will consume 40% of total metro bandwidth by 2005."[16] Datacom hotels "tend to be concentrated in the top 15 Tier One metros, which account for 80% of demand."[17] Nonetheless, today there are alternative collocation providers in virtually all major metropolitan areas throughout the country. *See* Appendix G.

That there are many different points of traffic concentration is competitively significant in two important respects. First, high-traffic-volume nodes provide network economies of scale to many smaller competitors, by consolidating their traffic at a single physical location. To obtain competitive transport, a CLEC no longer has to grow organically; it can, instead, just locate itself in the right building. Second, the major competitive fiber-optic providers in an area are all very likely to route their networks to these locations – thus effectively providing connection to all points served by all the competing networks combined. The CLECs themselves can hand off traffic to each other, or an intermediary can bundle and resell their services as a single, integrated competitive service. Thus, while any single competitive fiber network may serve only a select number of point-to-point routes, that carrier will have access to the point-to-point networks of other competing carriers as well. The universe of total competitive fiber – not the point-to-point routes of any individual competitor – defines the geographic areas within which competitive transport facilities are now available.

Three years ago, the Commission downplayed the competitive significance of competitive transport on the ground that CLECs "require dedicated transport facilities that are more extensive than those that are currently deployed along the point-to-point routes."[18] The Commission stated that, "[w]ithout access to the incumbent's ubiquitous transport facilities, competitive LECs are faced with the delays and costs of deploying their own transport facilities to meet the demand" or "must utilize a patchwork of competitive alternatives, where available, to collect and route traffic to the required destination."[19] Whatever the merits to that concern three years ago, the market itself has overtaken it today. Competitive transport networks now overlap and converge. Today, CLECs routinely seek out competitive suppliers of fiber; the supposed administrative costs of building patchwork solutions have been readily overcome.

Marketplace experience firmly establishes that carriers will seek out competitive suppliers of fiber, even where it means relying on a patchwork of different networks, rather than the ubiquitous facilities of an ILEC.[20] This is precisely the way the competitive access business began, with the large interexchange carriers purchasing competitive fiber in just a single

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goes through an EXDS data center. They also noted that during peak periods, they are transmitting sustained levels of 2.4 gigabits/sec of traffic across the Internet, which we believe makes EXDS the 3rd or 4th largest generator of traffic.").

[16] *Lehman/McKinsey MAN Report* at 6.

[17] *Id.* at 6-7.

[18] *UNE Remand Order* ¶ 346.

[19] *Id.*

[20] *See, e.g.*, Joint Comments of Allegiance Telecom, Inc. and Focal Communications Corporation at 5, *Implementation of the Local Competition Provisions of the Telecommunications Act of 1996*, CC Docket No. 96-98 (FCC filed June 11, 2001) ("Where it is available, Allegiance and Focal purchase transport and fiber from third parties.").

location, at first, and slowly expanding from there.[21] AT&T and WorldCom found the business so compelling, that they spent $25 billion to acquire their two largest suppliers.[22] Today, as discussed in more detail below, CLECs are purchasing as much fiber as they can from wholesale suppliers, even though these suppliers do not necessarily offer fiber everywhere. These suppliers obviously wouldn't even be in business if CLECs were willing to purchase transport only from suppliers who offered them ubiquitous connectivity.

B. CLEC Fiber.

At the time of the *UNE Remand Order*, the Commission found that, based on market conditions at the end of 1998, "competitive LECs have deployed transport facilities along selected point-to-point routes, primarily in dense market areas."[23]

Since that time there has been a further, sharp increase in the availability of competitive alternatives to ILEC interoffice transport facilities.[24] At the time of the *UNE Remand* proceedings, for example, CLEC fiber networks spanned approximately 100,000 route miles (both local and long-haul).[25] Today, CLEC networks consist of at least 184,000 route miles of fiber (both local and long-haul).[26] While many CLECs do not publicly report how many purely local route miles of fiber they operate, information from CLECs that do release such totals confirms that the majority of this fiber is local.[27]

While CLECs have significantly expanded their own local fiber networks, there also has been a rapid increase in local fiber supplied by "carrier-agnostic" wholesale suppliers. These companies have invested well over $1 billion in deploying local fiber networks that they sell or lease to other carriers. As a result, for a growing number of CLECs, the fiber provided by these wholesale suppliers satisfies a large part of their demand for interoffice transport.

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[21] *See* Section III.B.

[22] *See* AT&T News Release, *AT&T Completes TCG Merger* (July 23, 1998); WorldCom Press Release, *WorldCom, Inc. and MFS Announce Merger to Form Premier Business Communications Company* (Aug. 26, 1996).

[23] *UNE Remand Order* ¶ 333.

[24] This competitive transport is available to wireless carriers, just as it is to CLECs. Moreover, wireless base stations and switches (MTSOs) typically handle sufficient volumes of traffic to justify new fiber connections.

[25] *See NPRG CLEC Report 2000, 12th ed.*, Ch. 6 at Table 5 (restated 1998 route miles). As described in the following note, the latest NPRG report excludes fiber for competitive Independent Operating Companies, utility CLECs, data providers, and Gig-E providers. To make an apples-to-apples comparison with the 2001 totals, we have removed from the 1998 totals the fiber for carriers that NPRG has placed in one of these categories.

[26] *NPRG CLEC Report 2002, 15th ed.*, Ch. 2 at Table 7; Ch. 4. This is a highly conservative estimate. It does not include 117,000 route-miles of fiber that NPRG lists for competitive Independent Operating Companies, utility CLECs, data providers, or Gig-E providers. Moreover, the total miles for 2001 have been adjusted downward to address the concerns that CLECs raised in the Special Access proceeding in April of 2001 (CC Docket No. 96-98).

[27] For example, of the 33 CLECs for which NPRG provides fiber-route miles, we have found only four examples (Adelphia, McLeod, Time Warner Telecom, and XO) where, based on CLECs' own public disclosures, the total route miles reported by NPRG appear to include significant amounts of long-haul fiber. At the same time, the total route miles reported by NPRG are *lower* than local-only route-mile totals provided by at least two CLECs (AT&T and Cablevision) and do not include any fiber route miles for WorldCom, which is one of the two largest CLECs.

The first competitive transport services involved the provision of "access" between large business customers and interexchange carriers. New York authorized interoffice competition in 1985, and that year Teleport built a fiber-optic network in lower Manhattan, to provide special access service to business customers, where the most concentrated wire centers in the nation reside. Sixteen other states had followed New York's lead by August 1986.[28] Institutional Communications Company (ICC), the second major CAP, was formed in 1986 in Washington, D.C.; it is now a part of MCI/WorldCom's MFS.[29] In 1987, Chicago Fiber Optic (soon to be MFS) began building a network to provide special access in downtown Chicago.[30] By 1990, CLECs had deployed 20 networks in 15 cities.[31] By 1995, 29 CAPs had deployed fiber-optic networks in approximately 100 cities, consisting of more than 21,000 route miles of fiber.[32]

Since the last UNE review, the number of "operational" and "on-net" CLEC networks in the 150 largest MSAs – which contain nearly 70 percent of the U.S. population[33] – has grown from approximately 1,100 to nearly 1,800. *See* Appendix K.[34] During this period, the average number of CLEC networks in the 150 largest MSAs grew by more than 60 percent. *See* Table 4. Today, 91 of the top 100 MSAs are served by at least three CLEC networks; 77 are served by at least seven, 59 are served by at least 10. *See* Appendix K. As these data make clear, CLEC fiber is by no means limited to dense urban areas. CLECs also have deployed fiber far outside of urban areas to reach large business customers in suburban and rural areas.[35]

Table 4. Average Number of CLEC Networks by MSA

MSA Rank	1998	2001	Percentage Increase
1-25	19.6	32.2	64%
26-50	10.2	15.0	47%
51-75	5.2	9.0	73%
76-100	4.0	6.6	65%
101-125	2.8	4.8	71%
126-150	2.8	3.4	21%

Sources: See Appendix M.

[28] *See* Semilof, *IntraLATA Competition: Lata Barrier Falls*, Network World at 11 (Aug. 25, 1986).

[29] *See NPRG 1999 CLEC Report, 10th ed.*, Ch. 2 at 3.

[30] *See NPRG 1999 CLEC Report, 10th ed.*, Ch. 2 at 3.

[31] *See* U.S. Dep't of Commerce, *U.S. Industrial Outlook* at 33-7 (1990).

[32] *See* Connecticut Research, *1995/96 Local Telecommunications Competition* at Table II-2 (7th ed. 1995).

[33] Rand McNally, *Commercial Atlas and Marketing Guide 2001* at 60-61, 83 (132nd ed. 2000).

[34] For purposes of these totals, we have counted all "voice networks" and "data networks" that NPRG's *CLEC Report 2002* lists as "operational." These totals may include some networks or parts of networks that CLECs operate with facilities leased from a third party, including an ILEC.

[35] *See also, e.g.*, K. Fairbank, *RAIL SWITCH; Union Pacific Develops High-Tech Subsidiary*, Dallas Morning News at 1D (Oct. 18, 2000) (Ekanet, a subsidiary of the Union Pacific railroad, "aims to provide services to underserved, primarily rural, markets west of the Mississippi River"); *Fujitsu Equipment Drives New Fiber Network Serving Northwestern South Dakota*, Bus. Wire (Nov. 6, 2000) (South Dakota Network "is now offering advanced telecommunications services to customers in rural northwest South Dakota through a 600-mile fiber-optic network").

Finally, there are new technologies on the near horizon that would enable additional fiber to be deployed without digging up city streets, which "could cut the time and cost of fiber installation in half."[36] For example, "CityNet Telecommunications aims to revolutionize the rollout of broadband services in cities by dispatching tiny robots to lay fiber-optic cables in sewer pipes."[37] The company already has agreements to deploy fiber in nine major cities (Houston, Pittsburgh, Dallas, Scottsdale, Indianapolis, Fort Worth, Omaha, San Antonio, and Albuquerque),[38] and is in talks with dozens of other cities. In April 2001, the company announced that it had secured $275 million in a new round of financing, which "underscores the novelty and promise of the . . . company's business."[39]

Many of the competitive transport facilities that CLECs have deployed are used to provide special access services. Special access revenues constitute a very large share of all interoffice transport revenues. Moreover, these revenues are highly concentrated in a relatively small number of wire centers,[40] making them an easy target for CLECs to serve with their own facilities. The Commission has found that "the revenues of competitive LECs come primarily from special access and local private line services."[41] CLECs now account for between 28 and 39 percent of all special access revenue, which is significantly larger than their share of the local exchange market as a whole.[42]

C. Wholesale Suppliers of Local Fiber.

In the past few years, there has been a dramatic increase in fiber supplied by alternative wholesale suppliers, which typically sell or lease dark fiber to other carriers, but do not

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[36] P. Davidson, *Robots Lay Fiber Optics in City Sewers*, USA Today (Nov. 27, 2000).

[37] *Id.*

[38] CityNet News Release, *City of Houston and CityNet Telecommunications Announce Agreement To Wire City with Fiber Optic Networks Through Sewers* (Jan. 9, 2002); CityNet News Release, *City of Pittsburgh and CityNet Communications Announce Agreement to Wire City with Fiber Optic Networks Through Sewers* (Oct. 26, 2001); CityNet News Release, *Mayor Touts "Smart" Alternative to Trenching Streets* (Oct. 16, 2000); CityNet News Release, *CityNet Inaugurates the First-Ever U.S. Fiber Optic Network Deployment Through City Sewer System* (Feb. 20, 2001); CityNet News Release, *CityNet Launches Last-Mile Fiber Optic Network in Indianapolis* (June 13, 2001).

[39] *CityNet Wins $275 Million in Funding*, Wash. Post (Apr. 10, 2001).

[40] *See* USTA, *Competition for Special Access Service, High-Capacity Loops, and Interoffice Transport*, CC Docket No. 96-98, at 3 & Table 1 (FCC filed Apr. 5, 2001) ("more than 80 percent of SBC's special access revenues are generated in less than 25 percent of the wire centers in which it is providing special access. In Verizon's region, more than 80 percent of special access revenues are generated from about 20 percent of Verizon's total wire centers. In Qwest's region, more than 60 percent of special access revenues are generated from 11 percent of Qwest's total wire centers. In BellSouth's region, 91 percent of special access revenues are generated from 20 percent of BellSouth's total wire centers.").

[41] *Promotion of Competitive Networks in Local Telecommunications Markets*, First Report and Order and Further Notice of Proposed Rulemaking in WT Docket No. 99-217, Fifth Report and Order and Memorandum Opinion and Order in CC Docket No. 96-98, and Fourth Report and Order and Memorandum Opinion and Order in CC Docket No. 88-57, WT Docket No. 99-217; CC Docket No. 96-98; CC Docket No. 88-57, FCC 00-366, ¶ 24 (rel. Oct. 25, 2000).

[42] *See* Appendix L & Section V; *see also* Section I.D.